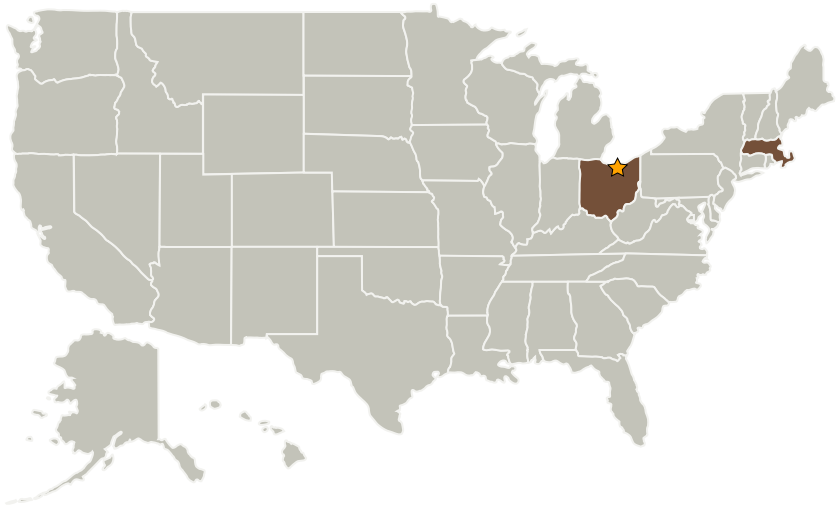
InN-Based Quantum Dot Solar Cells, Phase II

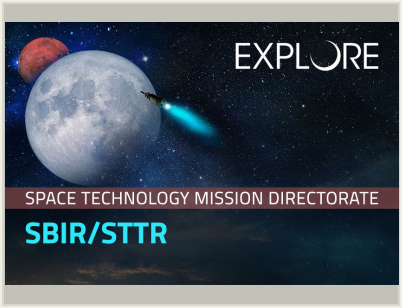
Completed Technology Project (2008 - 2010)

Project Introduction

The goal of this STTR program is to employ nanostructured materials in an advanced device design to enhance the tolerance of solar cells to extreme environments while maintaining high solar electric power conversion efficiency. By using InN-based quantum dots embedded within a higher band gap GaN barrier material, a larger fraction of the solar spectrum can be harnessed while minimizing the effects of high temperatures and high-energy radiation with this promising photovoltaic device. The wide range of energies accessible to InN-based materials provides unique flexibility in designing quantum dot solar cell structures. Phase I work demonstrated the feasibility of synthesizing device quality InN-based quantum dots. InN quantum dot assemblies were grown on GaN templates via metalorganic chemical vapor deposition and exhibited well defined x-ray diffraction peaks with dot densities up to 1E10 cm-2. More importantly, strong room temperature photoluminescence has been observed, with peak emission energies ranging from the infrared to the ultraviolet. These promising optical properties suggest it will be possible to build structures incorporating InN quantum dots within a GaN p-n junction to test the basic concepts of quantum dot solar cells during the Phase II effort. The principal Phase II objective is to develop an InN-based quantum dot solar cell capable of high performance in near-sun and extreme radiation environments. Ultimately our approach provides a pathway for realizing solar cells with over 2,000 W/kg of specific power and power conversion efficiency approaching 60%.

Primary U.S. Work Locations and Key Partners





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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Glenn Research Center (GRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

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Organizations Performing Work	Role	Type	Location
★Glenn Research Center(GRC)	Lead Organization	NASA Center	Cleveland, Ohio
Kopin Corporation	Supporting Organization	Industry	Taunton, Massachusetts

Primary U.S. Work Locations	
Massachusetts	Ohio

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.1 Photovoltaic